INCH-POUND
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SUPERSEDING
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w/CHANGE 2 (IN PART)
28 June 2013
(see 6.1)

DEPARTMENT OF DEFENSE

TEST METHOD STANDARD

METHOD 107, THERMAL SHOCK

AMSC N/A

FSC 59GP

FOREWORD

1. This standard is approved for use by all Departments and Agencies of the Department of Defense.

2. This entire standard has been revised. This revision has resulted in many changes to the format, but the most significant one is the splitting the document into test methods. See MIL-STD-202 for the change summary.

3. Comments, suggestions, or questions on this document should be emailed to std202@dla.mil or addressed to: Commander, Defense Logistics Agency, DLA Land and Maritime, ATTN: VAT, P.O. Box 3990, Columbus, OH 43218–3990. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

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METHOD 107
THERMAL SHOCK

1. SCOPE

1.1 Purpose. This test is conducted for the purpose of determining the resistance of a part to exposures at extremes of high and low temperatures, and to the shock of alternate exposures to these extremes, such as would be experienced when equipment or parts are transferred to and from heated shelters in arctic areas. These conditions may also be encountered in equipment operated noncontinuously in low-temperature areas or during transportation. Although it is preferred that the specimen reach thermal stability during the exposure specified, in the interest of saving time, parts may be tested at the minimum exposure durations specified, which will not insure thermal stability but only an approach thereto. Permanent changes in operating characteristics and physical damage produced during thermal shock result principally from variations in dimensions and other physical properties. Effects of thermal shock include cracking and delamination of finishes, cracking and crazing of embedding and encapsulating compounds, opening of thermal seals and case seams, leakage of filling materials, rupturing, or cracking of hermetic seals and vacuum glass to metal seals, and changes in electrical characteristics due to mechanical displacement or rupture of conductors or of insulating materials.

2. APPLICABLE DOCUMENTS

This section not applicable to this standard.

3. DEFINTIONS

This section not applicable to this standard.

4. GENERAL REQUIREMENTS

4.1 Apparatus. Suitable temperature controlled systems shall be used to meet the temperature requirements and test conditions specified in table I or table III. The liquid method is more severe and may damage some components that might not be degraded by the air method. It is not intended for use on nonhermetically sealed components.

4.1.1 Environmental chambers. A system of sufficient thermal capacity shall be used to change ambient chamber conditions to meet test requirements and to reach specified temperature conditions of steps 1 and 3 of table I. The supply air temperature of the chambers shall reach the specified temperature within a recovery time of 5 minutes after the specimens have been transferred to the appropriate chamber.

4.1.2 Liquid baths. Suitable temperature controlled baths containing liquids (see table IV) shall be chosen to maintain the specified test conditions (see table III) within the indicated tolerances. A liquid media shall not be used without prior approval of the qualifying activity.

4.2. PROCEDURE.

4.2.1 Environmental chambers. Specimens shall be placed so that there is substantially no obstruction to the flow of air across and around the specimen. When special mounting is required, it shall be specified. The specimen shall be subjected to the specified test condition of table I. The first five cycles shall be run continuously. After five cycles, the test may be interrupted after the completion of any full cycle, and the specimens allowed to return to room ambient temperature before testing is resumed. One cycle consists of steps 1 through 4 of the applicable test condition. Specimens shall not be subjected to forced circulating air while being transferred from one chamber to another. Whether single or multiple chambers are used, the effective total transfer time from the specified low temperature to the specified high temperature, or the reverse, shall not exceed 5 minutes. Direct heat conduction to the specimen should be minimized. In the case of multiple chambers, the transfer time shall be defined as the time between withdrawal from the low temperature chamber and introduction into the high temperature chamber or the reverse.

NOTE: In single compartment chambers, in which the temperature extremes of steps 1 and 3 are achieved without physical movement of the specimens, steps 2 and 4 are not applicable.

4.2.2 Liquid baths. Specimens shall be immersed in a suitable liquid that shall be approved by the qualifying activity (see table IV), at the temperature in step 1 of the specified test condition (see table III) for the time specified in table V. Immediately upon the conclusion of step 1, the device shall be transferred to a suitable liquid at the temperature specified in step 2 of the specified test condition. The device shall remain at the high temperature for the time specified in table V. These two steps, step 1 and 2, constitute one cycle of the applicable test condition. Repeat the required number of cycles without interruption as specified in table III. Transfer time from low to high temperature and from high to low temperature shall be less than 10 seconds.

4.3 Measurements. Specified measurements shall be made prior to the first cycle and upon completion of the final cycle, except that failures shall be based on measurements made after the specimen has stabilized at room temperature following the final cycle.

5. DETAILED REQUIREMENTS

5.1. Summary. The following details are to be specified in the individual specification:

a. Recovery time if other than 5 minutes (see 4.1.1).

b. Special mounting, if applicable (see 4.2).

c. Type test (air or liquid) and test condition (see 4.2).

d. Transfer time if other than specified in 4.2.1 or 4.2.2.

e. Measurements before and after cycling (see 4.3).

TABLE I. Thermal shock test conditions (air) 1/.

Step	Test condition	Number of cycles		Test condition	Number of cycles		Test condition	Number of cycles
	A	5		B	5		C	5
	A-1	25		B-1	25		C-1	25
	A-2	50		B-2	50		C-2	50
	A-3	100		B-3	100		C-3	100
	Temperature	Time		Temperature	Time		Temperature	Time
	°C			°C			°C	
1	-55 +0, -3	See table II		-65 +0, -5	See table II		-65 +0, -5	See table II
2	25 +10, -5	5 minutes		25 +10, -5	5 minutes		25 +10, -5	5 minutes
3	85 +3, -0	maximum		125 +3, -0	maximum		200 +5, -0	maximum
4	25 +10, -5			25 +10, -5			25 +10, -5	

Step	Test condition	Number of cycles		Test condition	Number of cycles		Test condition	Number of cycles
	D	5		E	5		F	5
	D-1	25		E-1	25		F-1	25
	D-2	50		E-2	50		F-2	50
	D-3	100		E-3	100		F-3	100
	Temperature	Time		Temperature	Time		Temperature	Time
	°C			°C			°C	
1	-65 +0, -5	See table II		-65 +0, -5	See table II		-65 +0, -5	See table II
2	25 +10, -5	5 minutes		25 +10, -5	5 minutes		25 +10, -5	5 minutes
3	350 +5, -0	maximum		500 +5, -0	maximum		150 +3, -0	maximum
4	25 +10, -5			25 +10, -5			25 +10, -5	

1/ When method 102, condition A, B or D has been specified use condition A.
When method 102, condition C has been specified use condition B

TABLE II. Exposure time in air at temperature extremes.

Weight of specimen	Minimum time (for steps 1 and 3)
	Hours
1 ounce (28 grams and below)	1/4 (or as specified)
Above 1 ounce (28 grams) to .3 pound (136 grams), inclusive	½
Above .3 pounds (136 grams) to 3 pounds (1.36 kilograms), inclusive	1
Above 3 pounds (1.36 kilograms) to 30 pounds (13.6 kilograms), inclusive	2
Above 30 pounds (13.6 kilograms) to 300 pounds (136 kilograms), inclusive	4
Above 300 pounds (136 kilograms)	8

TABLE III. Thermal shock conditions (liquid).

Step	Test condition	Number of cycles		Test condition	Number of cycles		Test condition	Number of cycles		Test condition	Number of cycles
	AA	5		BB	5		CC	5		DD	5
	AA-1	15		BB-1	15		CC-1	15		DD-1	15
	AA-2	25		BB-2	25		CC-2	25		DD-2	25
	Temperature	Time		Temperature	Time		Temperature	Time		Temperature	Time
1 2	°C -0 +2, -10 100 +10, -2	See table V		°C -65 +0, -10 125 +10, -0	See table V		°C -65 +0, -10 150 +10, -0	See table V		°C -65 +0, -10 200 +10, -0	See table V

TABLE IV. Suggested thermal fluids. 1/ 2/

Test condition	AA, AA-1, AA-2 fluids	BB, BB-1, BB-2 Fluids	CC, CC-1, CC-2 fluids	DD, DD-1, DD-2 fluids
Step 1	FC40 4/ or Water 3/ D02, D02-TS, D/80 } 6/	FC77 4/ D02, D02-TS, D/80 } 6/	FC77 4/ D02, D02-TS, D/80 } 6/	FC77 4/ D02, D02-TS, D/80 } 6/
Step 2	FC40 4/ Water 3/ D02, D02-TS, D03 } 6/	FC70, FC40 } 4/ UCON-WS 5/ D02, D02-TS, D03 } 6/	FC70, FC40 } 4/ UCON-WS 5/ D02, D02-TS, D03 } 6/	FC70 4/ UCON-WS } 5/ D05, LS/230, LS/215 } 6/

1/ See 4.2.2.
2/ Ethylene glycol shall not be used as a thermal shock test fluid.
3/ Tap water is indicated as an acceptable fluid for this temperature range. Its suitability chemically shall be established prior to use. A mixture of water and alcohol may be used to prevent freezing at the low temperature extreme. The water shall not be allowed to boil at the upper temperature extreme.
4/ FC77, FC70, FC40 are the registered trademark of 3M.
5/ UCON-WS process fluid is the registered trademark of Union Carbide Corporation.
6/ D02, D02-TS, D03, D05, D/80, LS/215 and LS/230 are the registered trademark of Ausimont (Division of Montedison).

TABLE V. Exposure time in liquid at temperature extremes.

Weight of specimen	Minimum time (for steps 1 and 2)
	Minutes
.05 ounce (1.4 grams) and below	½
Above .05 ounce (1.4 grams) to .5 ounce (14 grams)	2
Above .5 ounce (14 grams) to 5 ounces (140 grams)	5

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Supersession data. The main body and 38 parts of this revision of MIL-STD-202 replace superseded MIL-STD-202.

6.2 Cancelled Method. Method 102, Temperature Cycling is cancelled, when specified Method 107 is used.

102 test condition	107 test condition
A, B, and D	A
C	B

Custodians:
Army - CR
Navy - EC
Air Force - 85
DLA - CC

Review activities:
Army - AR, AT, AV, CR4, MI, SM, TE
Navy - AS, OS, SH
Air Force - 19, 99
NSA - NS

Preparing activity:
DLA – CC

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NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil/